

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in this application:

1. (Previously Presented) A method for making a piezoelectric transducer having a plurality of intertwined individual helical transducer segments comprising:
 - machining a ceramic material blank into a tubular configuration to form a ceramic tube;
 - coating the ceramic tube with a metallic layer;
 - machining helical grooves in the metal coated ceramic tube to form an inner electrode and a plurality of helically intertwined outer electrodes, each outer electrode having its own connection pad and electrical connection, and being associated with a functionally discrete transducer segment; and

transforming the ceramic material forming the ceramic tube into a piezoelectric crystal.
2. (Currently Amended) The method of claim 1 wherein the step of machining the ceramic material blank into the tubular configuration comprises core drilling and turning the blank using a CNC machine.
3. (Currently Amended) The method of claim 2 wherein the step of core drilling and turning the ceramic material blank comprises utilizing a quadruple YAG laser at about 700 nanometer wavelength, hooked to a rotary mandrel CAD/CAM machine.

4. (Original) The method of claim 1 wherein the step of coating the tubular ceramic material with a metallic layer comprises plating the tubular ceramic material using a metal plating process.

5. (Original) The method of claim 1 wherein the step of coating the tubular ceramic material with a metallic layer comprises sputtering the ceramic tube with metal using a sputtering process.

6. (Currently Amended) The method of claim 1 wherein the step of machining helical grooves comprises laser etching the metallic coating over the ceramic tube to form inner and outer electrodes.

7. (Currently Amended) The method of claim 1 wherein the step of machining helical grooves comprises laser etching the metallic coating over the ceramic tube to form helical grooves that segment the transducer into the functionally discrete transducer segments.

8. (Original) The method of claim 1 wherein the step of transforming the ceramic material forming the ceramic tube into a piezoelectric crystal comprises shorting the transducer segments.

9. (Original) The method of claim 8 wherein the step of shorting the transducer segments comprises creating a temporary connection of comparatively low resistance between the transducer segments.

10. (Original) The method of claim 1 wherein the step of transforming the ceramic material forming the ceramic tube into a piezoelectric crystal comprises poling the ceramic tube.

11. (Original) The method of claim 10 wherein the step of poling the ceramic tube comprises:

heating the ceramic tube beyond its Kerrie point; and
apply an electric field.

12. (Original) The method of claim 1 further comprising the step of polishing the outer surface of the ceramic tube before coating the ceramic tube with a metallic layer.

13. (Original) The method of claim 12 wherein the step of polishing the outer surface of the ceramic tube comprises:

mounting the ceramic tube to a spinning mandrel;
rotating the mandrel at a high rate of speed; and
contacting the rotating ceramic tube with a fine abrasive material.

14. (Previously Presented) The method of claim 1 further comprising the step of mounting the ceramic tube to a mandrel for additional support during machining.

15. (Original) The method of claim 1 further comprising the step of applying a matching layer over the segmented transducer.

16. (Original) The method of claim 15 wherein the step of applying a matching layer comprises laminating the matching layer over the transducer.

17. (Original) The method of claim 15 wherein the step of applying a matching layer comprises coating the transducer with a polymer using a process selected from the group consisting of spray coating, dip coating, chemical vapor deposition, plasma coating, co-extrusion coating, spin coating and insert molding.

18. (Cancelled)

19. (Cancelled)

20. (Previously Presented) A method for making a piezoelectric transducer having a plurality of intertwined individual helical transducer segments comprising:
machining a ceramic material blank into a tubular configuration to form a ceramic tube;

coating the ceramic tube with a metallic layer;
machining helical grooves in the metal coated ceramic tube to form an inner electrode
and a plurality of helically intertwined outer electrodes, each outer electrode being substantially
electrically insulated from the immediately adjacent outer electrode; and
transforming the ceramic material forming the ceramic tube into a piezoelectric crystal.